List of Tables

Appendix A. Work-off Plan for ECS-LaRC DAAC ICD

Abbreviations and Acronyms

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The Earth Science Data and Information System (ESDIS) Project has responsibility for the development and maintenance of this ICD. Any changes in the interface requirements must be agreed to, and assessed at the ESDIS Project Level. This ICD will be approved under the signature of the ESDIS Project Manager.

1.3 Purpose and Objectives

This document is written to formalize the interpretation and general understanding of the interfaces between ECS and non-ECS components of the Langley DAAC. This document provides clarification and elaboration of the ECS/non-ECS systems interfaces at the Langley DAAC to the extent necessary to assure hardware, software, and operational service compatibility within the end-to-end system.

This document provides a point of mutual control of external interface definitions via the ESDIS Configuration Control Board (CCB).

1.4 Status and Schedule

This is the final ICD for the ECS/non-ECS systems interfaces at the Langley DAAC which will be implemented in ECS Release A and Release B. This ICD has been submitted as an ECS Project CCB approval Code 1 document. At the Government's option, this document may be designated to be under full Government CCB control. Changes may be submitted for consideration by Contractor and Government CCBs under the normal change process at any time.

Within this document are some interfaces that have associated TBRs, TBSs and/or TBDs. A table providing a Work-off Plan is in Appendix A. This plan provides the following information:

a. ICD I/F Issue No.

b. ICD Reference Paragraph

c. ICD Issue Priority

d. ICD Issue Type - Description

e. Work-off Plan Task(s)

f. Projected Resolution Date

1.5 Organization

Section 1 provides information regarding the identification, scope, purpose and objectives, and organization of this document.

Section 2 provides a listing of the related documents which were used as a source of information for this document.

Section 3 provides an overview of the interfaces for ancillary data exchange between the V0 System and ECS at the Langley DAAC. This section also provides a context diagram.

Section 4 includes a detailed discussion of the data exchange framework. Specifically, the following topics are discussed: applicable internetworking protocols, network topology, polling with product delivery record, data transfer, product delivery record discrepancy, production acceptance notification, error conditions, error handling, backup methods, physical media, state diagrams, and data exchange security.

Section 5 address the data flows between ECS and the V0 System at the Langley DAAC. The specific ancillary data products exchanged are identified including product name, file name, frequency, file size, volume and format. The minimum required metadata is identified.

Appendix A contains a table which identifies a Work-off Plan for all TBRs, TBSs and/or TBDs.

A list of abbreviations and acronyms is also provided.

3. Interface Overview

The Langley DAAC serves the needs of the general science community by engaging in disciplines related to clouds, aerosol, radiation budget and tropospheric chemistry; and, specifically, by providing archival, data management, and distribution services in these disciplines, as well as product generation services for particular data sets. ECS at the Langley DAAC is responsible for the production of CERES science data products. Interfaces to ECS at the Langley DAAC are shown in Figure 3-1. The generation of certain CERES products depends on the availability of a number of data products (e.g., ancillary, etc.) which originate from various sources located both inside and outside of the Langley DAAC.

There are three basic categories of sources providing CERES-required data to ECS at the Langley DAAC for CERES product generation, including the following:

- External interfaces (i.e., between ECS and a non-ECS system) where both sides of the interface are inside the Langley DAAC (e.g., between ECS and the V0 System)
- External interfaces (i.e., between ECS and a non-ECS system) where ECS is located inside the Langley DAAC, and the non-ECS system is located outside the Langley DAAC (e.g., between ECS and NOAA)
- Internal interfaces (i.e., ECS-to-ECS interfaces) where one side of the interface is located inside the Langley DAAC, and the other side of the interface is located inside a different DAAC (e.g., between ECS at GSFC and ECS at Langley)

This ICD only addresses external interfaces within the confines of the Langley DAAC--i.e., between ECS and the V0 System. Also, it should be noted that discussions herein, of static data migration and V0/ECS interoperability pertain, specifically, to internetworking--however, these topics are addressed in further detail in the following documents:

- ~~Version 1~~ Version 1 Data Migration Plan
- ~~Interface~~ Interface Control Document between the EOSDIS Core System (ECS) and the Version 0 System for Interoperability

In particular, the Atmospheric Science Division (ASD) at Langley is responsible for providing SAGE-II Ozone Profile and SAGE-II Aerosol Profile data to the Langley DAAC (V0 System). The V0 System, in turn, makes these products available to ECS at the Langley DAAC to support CERES standard product generation. These products are made available to ECS via a "Polling with Product Delivery Record" data transfer mechanism which is described in further detail in Section 4.

A summary of the interfaces between ECS and the Langley DAAC (V0 System) is provided in Table 3-1. In particular, this table identifies the source, destination, interface message, data, and transfer mechanism.

4. Data Exchange Framework

This section addresses the applicable internetworking protocols and network topologies involved in the electronic dissemination of SAGE II Ozone Profile and SAGE II Aerosol Profile ancillary data from the V0 System to ECS at the Langley DAAC. In addition, the applicable handshake procedure, control messages, data exchange (i.e., file transfer), state diagrams, and data exchange security are addressed herein.

In addition to pertaining to V0/ECS ancillary data, sections 4.1 and 4.2 apply to the following internetworking interfaces:

- Internetworking for V0-to-V1 static data migration
- Internetworking between ECS and the Langley Campus via external networks
- Internetworking for V0/ECS interoperability

4.1 Internetworking Protocols and Network Topology

ECS provides internetworking services that are based on protocols and standards corresponding to layers 1 through 4 of the Open Systems Interconnection (OSI) Reference Model, specified in RFC 1510---these include, respectively, the physical, datalink, network, and transport layers. The transport layer protocol provides data consistency functions. The network, datalink and physical layers play significant roles in defining external interfaces (i.e., between ECS and non-ECS networks/systems). In particular, ECS routers provide the physical demarcation points between ECS networks and external networks/systems---the routing software (resident within routers) provides network layer services, while the interfaces on the router make up the datalink/physical layers.

4.1.1 Transport Layer Protocol

The transport layer protocol used for communications between ECS processes and non-ECS processes the Langley DAAC is the Transmission Control Protocol (TCP) specified in RFC 793. TCP is a connection-oriented, end-to-end reliable protocol designed to fit into a layered hierarchy of protocols which support multi-network applications. It provides for reliable inter-process communication between pairs of processes in host computers attached to networks within and outside of ECS.

The interface between TCP and an application process consists of a set of calls much like the calls an operating system provides to an application process for manipulating files. For example, there are calls to open and close connections and to send and receive data on established connections. It is also expected that TCP can asynchronously communicate with application programs such as those based on Distributed Computing Environment (DCE).

File transfers between ECS and the V0 System host computers are accomplished through the use of standard File Transfer Protocol (FTP). FTP, as described in RFC 959, is an internet standard for file transfers that support downloading of files, by a user (acting as a client), from a remote server.

4.3 Polling with Delivery Record and Data Transfer

This section addresses the polling with delivery record data transfer mechanism, error conditions, error handling/backup methods, and physical media.

4.3.1 Data Transfer

A "Polling With Product Delivery Record (PDR)" transfer mechanism is used by the ECS Ingest Subsystem to acquire SAGE-II ancillary data from the V0 System at the Langley DAAC. The ECS side of the interface is equipped with an FTP daemon--a computer program which invokes this data transfer mechanism. Specifically, the daemon:

- Automatically, and with operator-tunable periodicity, polls the server supplying the data (i.e., V0 System)
- Detects a PDR file in the Langley DAAC-designated directory via an FTP "-ls" command--i.e., gets a directory listing from a remote server.
- Acquires the Product Delivery Record file information via an FTP "get" command--i.e., initiates a single file transfer from a remote server to a local host/workstation.

On the Langley DAAC side of the interface (i.e., V0 System) an FTP daemon continually listens for incoming FTP requests, acts on each arriving FTP request, and routes each FTP request to the appropriate account, making the directory sub-tree available to ECS with the allowable privileges.

Once a PDR has been detected/acquired by ECS, the PDR is validated. In the event that the PDR is invalid, ECS automatically returns a Product Delivery Record Discrepancy (PDRD) via e-mail to the supplier system (i.e., V0 System). If the PDR is valid, ECS schedules to pull the ancillary data using an FTP "get" command; in this case no PDRD is sent. If the entire PDR is determined to be invalid, as reflected in a corresponding PDRD, none of its file groups is processed and none of the files is transferred by ECS. The PDR must be corrected and resubmitted. If a PDR contains multiple file groups for which one or more file groups contain errors, the file groups with errors are not processed. However, the file groups without errors are processed by ECS. The specific ancillary data sets transferred from the supplier system (i.e., V0 System) to ECS are identified in Section 5. After the ingest/archive process, ECS automatically returns a "Production Acceptance Notification (PAN)" via e-mail to the supplier system indicating success/failure, including detected errors. This data transfer mechanism is depicted in Figure 4-2. The definitions of the PDR, PDRD, and PAN are described in the paragraphs which follow. Operator tunable parameters for message (e.g., PDR, PDRD and PAN) transfer include the following:

- Time the supplier system waits to receive a PDRD (or PAN) before placing another PDR in directory

- Expiration Time---i.e., the elapsed time between placement of a PDR in the directory by the supplier system, and the deletion of the data from the file server by the supplier system.

All relevant operator tunable parameters will be documented in the operations procedures for the LaRC DAAC-Unique systems and ECS as an integral part of the DAAC operations Manual (DID 611)

Figure 4-2. Polling with Product Delivery Record and Data Transfer at Langley DAAC

4.3.2 Product Delivery Record

The purpose of the PDR is to announce the availability of ancillary data granules for transfer, including file names, location, and how long these granules will be available in that location. The PDR is generated and placed in an operator configurable (pre-specified) directory (e.g., ~~the~~ LaRC_V0_DRS ~~directory~~) on an operator configurable server by the system supplying the data (i.e., the V0 System) after the data files referenced in the PDR have been placed into their respective directories. ECS polls the system supplying the data, detects/acquires/validates the PDR, and schedules to pull the ancillary data.

The PDR format is comprised of a message header followed by a Standard Format Data Unit (SFDU) which consists of an Exchange Data Unit (EDU) label, a PDR Label, and Parameter-Value Language (PVL) Statements. This message structure is depicted in Figure 4-3. The detailed format for the message header and SFDU labels are defined in Table 4-1. The required PDR PVL parameters are depicted in Table 4-2. The PDR PVL statements are ASCII strings, having at most 256 characters, in the form: "Parameter = Value." The Value strings shown in Table 4-2 include pre-defined values shown by single quote marks and processor determined values. Processor determined values include ASCII strings, ISO times, and integers to be filled in with appropriate values by a V0 System processor during PDR creation. A sample PDR PVL is provided in Figure 4-4. The maximum allowed message length for a PDR is 1 megabyte. PDRs are validated to check that all required fields contain valid values and that the format of the PDR is correct and consistent with the standards. PDRs that adhere to the defined message standards shown in Tables 4-1 and 4-2 are accepted and processed. Unique file names are assigned to each PDR using the following convention:

FILENAME = xxxxx.yyyymmddhhmmss.PDR,

where

yyyymmddhhmmss = date

and

xxxxx = e.g., SAGE2 (i.e., related to the dataset)

[For example: FILENAME = SAGE2.19961231235959.PDR]

Additional information on SFDU and PVL can be found in the following documents:

- Consultative Committee for Space Data Systems (CCSDS), Standard Formatted Data Units -- Structure and Construction Rules, Blue Book
- Consultative Committee for Space Data Systems (CCSDS), Parameter Value Language Specification (CCSD0006), Blue Book

4.3.3 Product Delivery Record Discrepancy

The PDRD is sent by ECS to the supplier system (i.e., V0 System), via automatic e-mail, only in the event that the PDR cannot be successfully validated. The PDRD identifies any errors or problems that have been encountered. There are two forms of PDRD, including a short form (Table 4-3) and long form (Table 4-4). The short form is used for PDRs with header and label errors. The long form is used when some file groups in the PDR have invalid parameters. The PDRD consists of PVL Statements. Short and long PDRD PVL examples are provided, respectively, in Figure 4-5 and Figure 4-6. Unique e-mail names are assigned to each PDRD using the following convention:

FILENAME = xxxxx.yyyymmddhhmmss.PDRD,

where

yyyymmddhhmms = date

and

xxxxx = e.g., SAGE2 (i.e., related to the dataset)

[For example: FILENAME = SAGE2.19961231235959.PDRD]

4.3.4 Production Acceptance Notification

After the data have been ingested/archived by ECS, ECS automatically sends a "Production Acceptance Notification (PAN)" via e-mail to the supplier system (i.e., V0 System). The PAN file announces the completion of data transfer and archival, and identifies any errors or problems that have been encountered. There are two forms of the PAN available for use, including a short (Table 4-5) and a long (Table 4-6) form. The short form of the PAN is sent to acknowledge that all files have been successfully transferred, or to report errors which are not specific to individual files but which have precluded processing of any and all files (e.g., FTP failure). ~~used for error-free transfers and mainly communication related errors~~. If all files in a request do not have the same disposition, a long form of this message is employed. The PAN consists of PVL Statements. Short and long PAN PVL examples are provided, respectively, in Figure 4-7 and Figure 4-8. Unique e-mail names are assigned to each PAN using the following convention:

FILENAME = xxxxx.yyyymmddhhmmss.PAN,

where

yyyymmddhhmmss = date

and

xxxxx = e.g., SAGE2 (i.e., related to the dataset)

[For example: FILENAME = SAGE2.19961231235959.PAN]

Table 4-2. Required PDR PVL Parameters

Parameter	Description	Type/Format (Maximum/ Length in Bytes)	Value
ORIGINATING_SYSTEM	Originator of PDR	Variable String/ ASCII (20 B)	Processor Identifier (Concise, unique name representing external interface; e.g., "V0")
TOTAL_FILE_COUNT	Total number of files to transfer	Unsigned Integer/ ASCII (4 B)	1- 9999
EXPIRATION_TIME	ISO Time for data deletion from originating system. This time is set by the Langley DAAC based on available resources.	Fixed String/ ASCII (20B)	yyyy-mm-ddThh:mm:ssZ, where T indicates the start of time information and Z indicates "Zulu" time ~~and Z are literals~~
OBJECT	Start of file group parameters (repeat for each group of files)	Fixed String/ ASCII (10B)	'FILE_GROUP'
DATA_TYPE	ECS Data Type	Variable String/ ASCII (20 B)	Valid ECS Data Type, as listed in Table 5-1
NODE_NAME	Name of network node on which the file resides	Variable String/ ASCII (64 B)	e.g., 'servername.larc.nasa.gov'
OBJECT	Start of file parameters (repeat for each file in filegroup)	Fixed String/ ASCII (9B)	'FILE_SPEC'
DIRECTORY_ID	File directory name (i.e., path name)	Variable String/ ASCII (256 B) (See Note 1)	e.g./SAGE_II/GROUP1/
FILE_ID	File name	Variable String/ ASCII (256 B) (Note 1)	File Name
FILE_TYPE	File data type	Variable String/ASCII (20 B)	e.g., Metadata, Science data, Browse, etc.
FILE_SIZE	Length of file in bytes	Unsigned 32-bit Integer/ ASCII (10 B)	< ~~4.296~~ 2*10^{9}
END_OBJECT	End of file parameters (repeat for each file)	Fixed String/ ASCII (9 B)	FILE_SPEC
END_OBJECT	End of file group (repeat for each group of files)	Fixed String/ ASCII (10 B)	FILE_GROUP

Note 1. Size can vary up to 256 bytes total when DIRECTORY_ID is combined with FILE_ID

```
                                                                              EXAMPLE ONLY
ORIGINATING_SYSTEM = V0_1;
TOTAL_FILE_COUNT = 73;
EXPIRATION_TIME = 1999-07-19T15:00:00Z;
OBJECT = FILE_GROUP;
        DATA_TYPE = SAGE01;
        NODE_NAME = servername.larc.nasa.gov;
        OBJECT = FILE_SPEC;
                DIRECTORY_ID = /SAGE_II/GROUP1/;
                FILE_ID = sage2_aer_prf_yymm;
                FILE_TYPE = Science Data;
                FILE_SIZE = 8850000;
        END_OBJECT = FILE_SPEC;
        OBJECT = FILE_SPEC;
                DIRECTORY_ID = /SAGE_II/GROUP1/;;
                FILE_ID = sag2_ozn_prf_yymm;
                FILE_TYPE = Metadata;
                FILE_SIZE = 10000;
        END_OBJECT = FILE_SPEC;
        ------------------------------------------------------------------------------------
        /* Repeat FILE_SPEC objects for each V0 data file within file group */
        ------------------------------------------------------------------------------------
END_OBJECT = FILE_GROUP;
        ------------------------------------------------------------------------------------
        /* Repeat FILE_GROUP objects for each different file group */
        ------------------------------------------------------------------------------------
                                                                              EXAMPLE ONLY
```

Figure 4-4. Example PDR PVL For V0 Data Files

Table 4-3. Short Product Delivery Record Discrepancy PVL Parameters

Parameter[2]	Description	Type/Format (Length in Bytes)	Value[2]
MESSAGE_TYPE	Short Product Delivery Record Discrepancy	~~Unsigned Integer/ASCII (1)~~ Fixed String/ASCII (10)	~~2~~ Short PDRD
DISPOSITION	Disposition of Ingest Request[1]	Variable String/ASCII (64)	~~invalid mission ID~~ invalid file count ~~other errors~~ ECS internal error ~~invalid PDR length~~ ~~invalid aggregate length~~ database failures ~~invalid expiration date~~ invalid PVL statement ~~no data provider~~ Missing ORIGINATING_SYSTEM parameter data provider request threshold exceeded data provider volume threshold exceeded system request threshold exceeded system volume threshold exceeded

Note 1. In any given instance, only one disposition value is provided. In cases where multiple errors have occurred, the disposition value corresponding to the first error encountered will be provided.

Table 4-4. Long Product Delivery Record Discrepancy PVL Parameters

Parameter[2]	Description	Type/Format (Length in Bytes)	Value[2]
MESSAGE_TYPE	Long Product Delivery Record Discrepancy	~~Unsigned Integer/ASCII (1)~~ Fixed String/ASCII (9)	~~3~~ Long PDRD
NO_FILE_GRPS (to follow)	Number of File Groups with Errors	Integer/ASCII (4)	Number of File groups, in PDR, with errors
For each file group having errors in the PDR			
DATA_TYPE	ECS Data Type	ASCII String (20)	DATA_TYPE in PDR
DISPOSITION	Disposition of Ingest Request[1]	Variable String/ASCII (64)	~~invalid data version~~ invalid data type* invalid directory* invalid file size ~~invalid time/date format~~ invalid ~~short~~ file ID* invalid node name* invalid file type*

Note 1. In any given instance, only one disposition value may be provided. In cases where multiple errors have occurred, the disposition value corresponding to the first error encountered will be provided.

Note 2. Each parameter/value statement is followed by an EOL mark.

* Null string check only

```
MESSAGE TYPE = ~~2~~ Short PDRD;                    EXAMPLE ONLY
DISPOSITION = DATABASE FAILURES;
```

Figure 4-5. Example Short PDRD PVL

```
MESSAGE_TYPE = ~~3~~ Long PDRD;                     EXAMPLE ONLY
NO_FILE_GRPS = 2;
DATA_TYPE = NCEP01;
DISPOSITION = INVALID DATA TYPE:
DATA_TYPE = NCEP02;
INVALID SHORT FILE ID;
```

Figure 4-6. Example Long PDRD PVL

Table 4-5. Short Production Acceptance Notification PVL Parameters

Parameter[2]	Description	Type/Format (Length in Bytes)	Value[2]
MESSAGE_TYPE	Short Production Acceptance Notification Definition	~~Unsigned Integer/ASCII (1)~~ Fixed String/ASCII (9)	~~2~~ Short PAN
DISPOSITION	Disposition of Ingest Request[1]	Variable String/ASCII (64)	Successful Network Failure Unable to Establish FTP Connection ~~Host Denied Access~~ All File Groups/Files not found FTP failure ~~- Too many errors in file transfer~~ ~~Post-transfer double-check failed~~ FTP command error ~~failed to add file to the preprocess list~~ ECS internal error ~~failed to get needed data from PDR~~ ~~Class construction failed~~ ~~File transfer failed~~ Request Canceled Metadata preprocessing error Resource allocation failure ~~Recovery Failure~~ Data base access error Incorrect number of metadata files Incorrect number of science files Incorrect number of files Data conversion failure ~~Metadata checking failure~~ Unknown data type invalid or missing file type File I/O error Data archive error
TIME_STAMP	ISO Time when Destination System ~~completed data transfer and validation~~ transferred the last part of data	ASCII (20)	yyyy-mm-ddThh:mm:ssZ, where T indicates the start of time information and Z indicates “Zulu” time ~~and Z are literals~~

Note 1. In any given instance, only one disposition value may be provided. In cases where multiple errors have occurred, the disposition value corresponding to the first error encountered will be provided.

Note 2. Each parameter/value statement is followed by an EOL mark.

Table 4-6. Long Production Acceptance Notification PVL Parameters

Parameter[2]	Description	Type/Format (Length in Bytes)	Value[2]
MESSAGE_TYPE	Long Production Acceptance Notification	~~Unsigned Integer/ASCII (1)~~ Fixed String/ASCII (8)	~~12~~ Long PAN
NO_OF_FILES	Number of Files in PDR	ASCII (4)	TOTAL_FILE_COUNT parameter in PDR
For each File in the PDR			
FILE_DIRECTORY	ASCII string specifying file directory location	ASCII (<256) Equivalent to PDR length	DIRECTORY_ID parameter in PDR
FILE_NAME	File names on system creating PDR	ASCII (<256) Equivalent to PDR length	FILE_ID parameter in PDR
DISPOSITION	Disposition of Ingest Request[1]	Variable String/ASCII (64)	Successful Network Failure Unable to Establish FTP Connection ~~Host Denied Access~~ All File Groups/Files not found FTP failure ~~- Too many errors in file transfer~~ ~~Post-transfer double-check failed~~ FTP command error ~~failed to add file to the preprocess list~~ ECS internal error ~~failed to get needed data from PDR~~ ~~Class construction failed~~ ~~File transfer failed~~ Request Canceled Metadata preprocessing error Resource allocation failure ~~Recovery Failure~~ Data base access error Incorrect number of metadata files Incorrect number of science files Incorrect number of files Data conversion failure ~~Metadata checking failure~~ Unknown data type invalid or missing file type File I/O error Data archive error
TIME_STAMP	ISO Time when Destination System transferred the last part of the data	ASCII (20)	yyyy-mm-ddThh:mm:ssZ, where T indicates the start of time information and Z indicates "Zulu" time ~~and Z are literals~~

Note 1. In any given instance, only one disposition value may be provided. In cases where multiple errors have occurred, the disposition value corresponding to the first error encountered will be provided.

Note 2. Each parameter/value statement is followed by an EOL mark.

```
MESSAGE_TYPE = 2 Short PAN;                                    EXAMPLE ONLY
DISPOSITION = INCORRECT NUMBER OF METADATA FILES;
TIME_STAMP = 1996-06-23T09:46:35Z;
```

Figure 4-7. Example Short PAN PVL

```
MESSAGE_TYPE = 12 Long PAN;                                    EXAMPLE ONLY
NO_OF_FILES = 2;
FILE_DIRECTORY = SAGE_II/GROUP1;
FILE_NAME = sage2_aer_prf_yymm;
DISPOSITION = UNABLE TO ESTABLISH FTP CONNECTION;
TIME_STAMP = 1996-04-28T23:49:59Z;
FILE_DIRECTORY = SAGE_II/GROUP1;
FILE_NAME = sag2_ozn_prf_yymm;
DISPOSITION = DATABASE ACCESS ERROR;
TIME_STAMP = 1996-11-28T21:39:49Z;
                                                               EXAMPLE ONLY
```

Figure 4-8. Example Long PAN PVL

4.3.5 Error Conditions

During the course of data exchange via FTP, the following error conditions may arise:

- Failure to establish TCP/IP connection
- Erroneous FTP command
- File not found (listed in PDR, but not found on disk)
- File not readable due to permissions

4.3.6 Error Handling/Backup Methods

Should a problem develop during and FTP file transfer due to any of the above error conditions, an operator-tunable number of attempts are made to pull the data. In the event that problems cannot be resolved within this operator-tunable number of attempts, ECS and the V0 System operations personnel have the option to coordinate data delivery on approved high density storage media (see section 4.3.7). While the use of tape media as a backup is not a requirement, it may be useful during emergencies, and is supported by both ECS and the V0 System.

In the event that tape media are used during emergencies, a separate Physical Media Product Delivery Record (PMPDR) file must be supplied for each piece of media delivered to ECS. The PMPDR must, both, be contained as a file on the media and be available separately as hard copy---in the event that a file check on the media by ECS reveals that the PMPDR is missing, DAAC operations personnel will supply ECS operations personnel with a hardcopy PMPDR. The format and information content for the PMPDR is the same as that for the PDR defined in Tables 4-1 and 4-2 (excluding EXPIRATION_TIME).

4.3.7 Physical Media

A variety of approved high density storage media will be available for providing backup during data transfer including the following:

a. 8 mm tape [112 meters; 5GB standard capacity]

b. 4 mm digital audio tape (DAT) [90 meters; 2GB standard capacity]

Data are distributed uncompressed. The blocking factor is 127. The TAR tape format is supported. Paper labels for each tape identify the names of files contained on the tape and the order in which these files have been written.

4.4 State Diagrams

This section specifies the state machine representations for the V0 System and ECS at the Langley DAAC. State machines are depicted using a state diagram based on the following standardized conventions, as depicted in the example in Figure 4-9:

- States are represented by labeled vertical bars
- Transitions from one state to another are represented by horizontal arrows which connect the source and destination states.
- Events (message receipt/time-outs) and conditions that trigger a transition appear above the arrow.
- Actions performed when the transition occurs are shown below the arrow.
- Once in a state, the system will remain there until a condition transition is true.

Figure 4-9. Example Depicting Standard Conventions For State Diagrams

4.4.1 V0 State Diagram

This section describes the interaction between the system providing the data (i.e., V0 System) and ECS, from the standpoint of the supplier system, with respect to the retrieval of any given ancillary data product from the supplier system. This interaction is depicted in Figure 4-10 in the form of a state diagram. The PDR and data are transferred using standard FTP communications. The following states are discussed in this section:

- Data Not Available
- Wait Until Expiration Time is Exceeded
- Error(s)
- Done

Figure 4-10. V0 State Diagram at Langley DAAC

4.4.1.2 Wait Until Expiration Time is Exceeded

In the "Wait Until Expiration Time is Exceeded" State, the supplier system (i.e., V0 System) is waiting for the expiration time (defined in the PDR) to be exceeded, after which data can be deleted from the local host. The following events/conditions, actions and transitions may occur while the supplier system is in this particular state:

- If a failure occurs in this state such that the data product cannot be accessed on the data host as specified in the PDR, the supplier system (i.e., V0 System) transitions to the "Error(s)" State.
- When the expiration time has been exceeded the supplier system (i.e., V0 System) transitions to the "Done" state.

4.4.1.3 Error(s)

In the "Error(s)" State, error handling operations are carried out by Langley DAAC (V0 System) operator. While the supplier system is in this particular state, the operator terminates the process, and all of the scheduled supplier system state transitions.

4.4.1.4 Done

The "Done" State indicates that the expiration time has been exceeded without any evidence of a data host failure.

4.4.2 ECS State Diagram

This section describes the interaction between the supplier system (i.e., V0 System) and ECS, from the ECS standpoint, with respect to the retrieval of any given ancillary data product from the supplier system. This interaction is depicted in Figure 4-11 in the form of an ECS State Diagram. The PDR and data are transferred using FTP communications.

The following states are discussed in this section:

- PDR Not Detected
- Transfer PDR
- Await PDR Validation
- Transfer Data
- Error(s)
- Done

Figure 4-11. ECS State Diagram at Langley DAAC

4.4.2.1 PDR Not Detected

In this state, ECS is periodically polling to detect the presence of a PDR on the supplier side of the interface. When a PDR is detected, ECS initiates the transfer and transitions to the ~~ÒTransfer PDRÓ~~ "Transfer PDR" state.

4.4.2.2 Transfer PDR

While in this state, ECS is executing file transfers to acquire the detected PDR. After the transfer of the PDR is successfully completed ECS will set a time-out and transition to the "Await PDR Validation" state.

4.4.2.3 Await PDR Validation

While in this state, ECS is waiting for validation of the PDR to be completed and for resources to become available. The following events/conditions, actions and transitions may occur while ECS is in this particular state:

- If the PDR is valid, ECS transfers the PDR (provided that resources are available) and transitions to the “Transfer Data” state.
- If the PDR is invalid, ECS notifies the operator and transitions to the “Error(s)” state.

It should be noted that for the sake of simplicity, the occurrence of invalid PDRs is not depicted in other states. Whenever an invalid PDR is identified, ECS notifies the operator and transitions to the ~~ÒError(s)Ó~~ “Error(s)” state.

4.4.2.4 Transfer Data

While in this state, ECS is executing file transfers to acquire the data. Once the transfer of data is successfully completed, ECS transitions to the "Done" state.

4.4.2.5 Error(s)

In the "Error(s)" State, ECS is waiting for error handling to be executed by the ECS/supplier system operators. While ECS is in this particular state, the operator terminates the process, and ECS transitions to the "Done" state.

4.4.2.6 Done

The "Done" State terminates the process and occurs when ECS has successfully retrieved all of the data files.

4.5 Data Exchange Security

Ancillary data transfer from the provider (i.e., V0 System) is initiated by ECS via FTP "get" commands (see Table 5-1 for specific data sets). Security is provided via basic password authentication during login.

Appendix A. Work-off Plan for ECS-LaRC DAAC ICD

ICD Issue #	ICD Para. #	Issue Priority*	ICD Issue Type - Description	Work-off Plan Task(s)	Projected Resolution Date	Risk Assessment**
4	2.2 5.1	A	ECS Ingest needs documentation of HDF-formatted SAGE-II data sets which will be supplied to ECS by the LaRC DAAC's V0 System to support CERES Product Generation for the TRMM Mission starting at Release A.	ECS (Ingest, Science Office, et al) will coordinate with the LaRC DAAC, Instrument Team and ESDIS to obtain needed documentation.	10/31	1. System I&T activity for Rel A, as planned, cannot be completed as Ingest S/W may require design changes to comply with HDF-formatted SAGE-II data set requirements.

* Issue Priority Definition:

A = Design impact; e.g., unresolved interface.

B = Minimal design impact; e.g., content or format of a specific field unresolved.

C = No design impact - administrative detail; e.g., reference document # not available.

** Risk Assessment Definition:

1 - Risk if issue is not resolved by CDR

2 - Risk if issues is not resolved by projected resolution date